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AUTHOR Kalyan-Masih, Violet
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ABSTRACT

Children's drawings of "a house with a tree behind it" were analyzed for (1) developmental changes in graphic representation over a 3-year period; (2) relationship with Piagetian tasks (the Nebraska Wisconsin Cognitive Assessment Battery of the NC-124), Peabody IQ, and WISC-R; and (3) correspondence with the Luquet-Piaget sequence of graphic representation - scribbling, fortuitous realism, failed realism, intellectual realism, and visual realism. Forty 3-year, 41 6-year, and 40 9-year old children from rural Nebraska were tested in 1976, 1977, and 1978. Additional cohorts were added in 1977 and 1978 as controls for repeated test effects. The total sample consisted of 121 3-, 6-, and 9-year-old children in 1976, 173 4-, 7-, and 10-year-old children in 1977; and 244 5-, 8-, and 11-year-old children in 1978. Developmental changes in performance on the House-Tree task were significant, even with repeated test effects controlled. Performance corresponded significantly with performances on the selected Piagetian tasks and WISC-R Block Design at all ages. Regression equations were computed for prediction. The Luquet-Piaget sequence was inferred with additional intervening strategies between intellectual and visual realism. The House-Tree task appears to have potential for assessing the cognitive development of younger children. (Author/SS)

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Piagetian Perspective in Draw-a-House Tree Task: A Longitudinal Study* of the Drawings of Rural Children in the State of Nebraska, USA

by

Violet Kalyan-Masih, Ph.D.
University of Nebraska, Lincoln, Nebraska

for

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Abstract

Children's drawings of "a house with a tree behind it" were analyzed for developmental changes across time; relationship with Piagetian tasks (the Nebraska Wisconsin Cognitive Assessment Battery of the NC-124), Peabody IQ, and WISC-R; and correspondence with the Luquet-Piaget sequence of graphic representation - scribbling, fortuitous realism, failed realism, intellectual realism, and visual realism. Forty 3-year, 41 6-year, and 40 9-year old children from rural Nebraska were tested in 1976, 1977, and 1978. Control cohorts were added in 1977 and 1978. Total sample consisted of 121 3, 6, and 9-year old children in 1976, 173 4, 7, and 10-year old children in 1977; and 224 5, 8, and 11-year old children in 1978. Significant developmental changes in House-Tree task with repeated test effects controlled were noted. The House-Tree corresponded significantly with selected Piagetian tasks and WISC-R Block Design at all ages. Regression equations were computed for prediction. The Luquet-Piaget sequence was inferred with additional intervening strategies between intellectual and visual realism. The House-Tree task has potential for assessing cognitive development of younger children. Its use with older children of restricted mental functioning needs to be explored.

Piagetian Perspective in Draw-a-House Tree Task: A Longitudinal Study of the Drawings of Rural Children in the State of Nebraska, U.S.A.

by

Violet Kalyan-Masih, Ph.D.
University of Nebraska, Lincoln, Nebraska

Graphic representation or drawing is one of the five semiotic functions (symbolic play, deferred imitation, drawing, mental imagery, and verbal evocation) of the preoperational period according to Piaget and Inhelder (1969). While discussing the evolution of graphic representation among children and endorsing the Luquet stages and interpretations of children's drawings these authors further state:

> Thus we see that the evolution of drawing is inseparable from the whole structuration of space, according to the different stages of this development. It is not surprising, then, that the child's drawing serves as a test of his intellectual development. (p. 68)

Very few Piagetian researchers, however, have investigated graphic representation from this perspective. Out of several hundred articles published during 1970-74 in Developmental Psychology and Child Development very few were related to graphic representation within the Piagetian framework. Of special relevance was one (Janikoun & Freeman 1972) which noted cognitive changes from intellectual to visual realism in the drawings of children between the ages of 7 and 8 years.

Clinical psychologists and psychiatrists have frequently used children's drawings as projective measures of personality. Goodenough's (1926) Measurement of Intelligence by Drawing, later revised and published as the Goodenough-Harris Drawing Test (1963), is one of the few systematic efforts to assess cognitive maturity from drawings.

Other scholars have analyzed children's drawings from the artistic perspective of order and balance (Kellogg 1969); structure within the limits of graphic medium (Arnheim 1979); and repetition, economy, sequence, and maintenance of physical

boundry and space of units/parts of a design (Goodnow, 1977).

In an earlier investigation this author tentatively supported the Luquet-Piaget sequence (scribbling, fortuitous realism, failed realism, intellectual realism, and visual realism) in children's drawings of a "house with a tree behind it" (Kalyan-Masih, 1976). In this study, several strategies used by children in decentering from intellectual to visual realism were noted. In analyzing these drawings the criterion was not the artistic quality but rather the problem solving strategies of representing a three dimensional 'front-behind' relationship on a two dimensional sheet of paper.

Statement of the Problem

A three-year longitudinal study[1] was undertaken to investigate the mental and social development of rural children. In Nebraska, this study also included the investigation of graphic representation. More specifically, the main objectives of this part of the study were to determine: 1) if the drawings of "a house with a tree behind it" would reflect developmental changes for 3-5, 6-8, and 9-11 year old children; 2) if these changes would correspond with their cognitive performance; and 3) if these drawings with their various strategies (new or old) would reflect the Luquet-Piaget sequence in general.

Sample

Multistage area sampling techniques[2] meeting the NC-124 guidelines of 'representative randomness', stratified by defined criteria[3] of ruralness, farm-derived income, family-intactness, and appropriate age were used for selecting the sample. Additional cohorts were added at each of the three age levels to the initial sample pool in the second (1977) and the third (1978) of data collection as controls for the repeated test effects. Table 1 describes the sample used in Nebraska for data collection during 1976, 1977, and 1978.

(Insert Table 1 about here)

Underlined entries are approximate mean ages and arrows indicate continuity of subgroups designated numerically to facilitate description and analysis.

Instruments and Data Collection

The relevant assessment measures are:

1. House-Tree Task (HT). Children were requested to draw the picture of a house with a tree behind it and encouraged to tell about their pictures. The tester noted all the spontaneous comments made by the child and observed especially the sequence of drawing (if the house or the tree was drawn first). These drawings were later scored on a revised scale of 1-11 points.

2. The Nebraska Wisconsin Cognitive Assessment Battery[4] (NWCAB), derived from the Piagetian theory, was used for collecting cognitive data. The Testing Kit contains toy-type testing materials for the 16 tasks. The arrangement of these tasks is described in Table 3.

(Insert Table 3 about here)

3. Two standard measures - Peabody Picture Vocabulary Test (PPVT) and Wechsler Intelligence Scale for Children - revised edition (WISC-R) were also administered in the standard manner. PPVT was administered to all the three age levels, but four of the subscales of WISC-R -- Information, Vocabulary, Picture Completion and Block Design were administered to age level 2 and age level 3 only.

The instruments described above were individually administered in one session in a child's home or in a mutually agreed upon location. The testing time varied from 40-60 minutes with provision for a break during the testing session. Standardized procedures for administering, scoring, and coding were followed.

Findings and Implications

A. Quantitative Analysis

For the first objective, ANOVA and Scheffé tests were used for comparing the mean performances of different sub-groups for significance. Two trends were noted. First, the three-year longitudinal sample (group 1, 2, and 3) at each age level made significant mean gains on HT from 1976 to 1977 to 1978. The two-year longitudinal sample (group 4 and 5) at each age level also made significant mean gains from 1977 to 1978. Thus there was a significant im-

provement in HT drawings across time at each age level. Could these significant mean gains be attributed to practice effects? To check this, the mean performance of cohorts was compared with that of their control counterparts at each age level. No significant mean differences were noted so practice effects might be ruled out. This was the first important trend suggested by these data: significant intra subject improvement in graphic representation across time. The second trend noted was a stepwise upward progression in mean scores across ages from younger to older children. The younger children scored low on HT and the older ones scored high. There were no reversals either. These increases in mean scores from younger to older children in an ordered direction suggested inter-subject progression across age levels.

The second objective was to investigate if changes in performance of children on graphic representation corresponded with their cognitive performance on selected Piagetian tasks and two Standard measures, the PPVTIQ and the WISC-R. This was done in three ways. First, by examining the zero-order Pearson correlation coefficients between variables; second, by performing regression analyses and by computing regression equations; and third, by plotting the graphs of means after converting these to a proportionate percentage of the maximum score for each task - for comparing performance between HT and Piagetian tasks (figure 1).

First, data analyses showed that HT correlated significantly with several Piagetian tasks at each age level. Some empirical relationship between HT and selected Piagetian tasks is, therefore, postulated. This relationship was confirmed in an earlier study (Kalyan-Masih, 1976). HT correlated significantly with PPVTIQ at ages 3, 5, 6, and 9. The HT also correlated significantly with WISC Picture Completion Scale at ages 7, 8, and 9. However, HT correlated positively and significantly with WISC Block Design at ages 6, 7, 8, 9, 10, and 11. It may, therefore, be tentatively concluded that PPVT and three subscales of WISC tap a different set of abilities from HT, but that HT and WISC

Block Design may possibly overlap in assessing a similar set of abilities at ages 6 through 11. In an earlier study significant and positive relationships between HT and Stanford Binet were found, suggesting overlap, in spite of different theoretical formulations (Kalyan-Masih, 1976).

Second: multiple regression analyses were performed to find how the predictor variables (Piagetian tasks) explained a portion of variance in the criterion variable (HT). Using the forward stepwise multiple regression analysis procedure several multiple regression equations, with regression coefficients being significant, were computed at each age level. Alternately, the simple regression analyses were performed for predicting a selected Piagetian task from HT. Several simple regression equations, with regression coefficients being significant were computed at each age level.

Third, means expressed as a proportionate percentage of the maximum score for each task were plotted for each age level across the three years in several line graphs (figure 1). These lines were neither coincident nor perfectly parallel, but showed an upward trend from 1976--1977--1978, suggesting correspondence in performance between HT and Piagetian tasks across time.

B. Qualitative Analysis

For the third objective: if changes in HT performance reflected the Luquet-Piaget sequence of graphic representation, a qualitative analysis of 518 drawings of "a house with a tree behind it" was done. The Luquet-Piaget sequence of graphic representation was inferred from HT drawings. Also noted were several intriguing strategies used by children in decentering from intellectual to visual realism. These strategies were:

1. Transitional strategy: The tree drawn <u>inside</u> a house looks funny to the child, so now he toys with the idea of drawing the tree somewhere <u>outside</u> the house (beside or in front or sitting on top of the roof).
2. Compromise solution: Both the tree and the house must remain visible but

a solution may be contrived when the tree may reasonably be considered behind the house such as:

-Drawing the house on one side of the paper and the tree on the reverse side.

-Drawing the tree first and then superimposing a house on it.

-Drawing a far away tree on a hill.

-Drawing a tree which is seen through a large open window.

3. Partial solution: The child seems willing to let go of part of the trunk. The tree is now drawn so that part of the trunk is barely visible from behind the side wall or above the roof.

The following summarizes the qualitative analysis of these data:

1. Scribbling - Sensory motor pleasurable activity with little or no representation.

3-5 YEARS

2. Fortuitous Realism - 'Front-behind' relationship is completely ignored. Interest is centered on the discovery that lines/dots can represent something.

3. Failed Realism - The details are juxtaposed or drawn appropriately. Attention is focused on drawing a tree and a house rather than a tree behind the house.

4. Intellectual Realism - First time the front-behind relationship is handled.

Tree is drawn inside the house.

6-8 YEARS

a. Transitional - Tree is placed outside the house.

b. Compromise - Four contrived situations when the tree may reasonably be considered behind the house.

c. Partial - Partially hidden and partially visible tree trunk.

9-10 YEARS

5. Visual Realism - Tree top is seen above the roof of the house.

These findings suggested that the graphic representation improved with age and that this improvement was associated with their cognitive performance during the

preoperational period. The Luquet-Piaget sequence was inferred with additional intervening strategies between intellectual and visual realism.

The HT task is simple and economical. It used minimum language which may be of advantage when assessing younger children between the ages of three and seven. After age 8, HT begins to lose its discriminating effectiveness because of the ceiling effect imposed by the score range. However, its usefulness for older children functioning within a restricted mental range needs to be further explored. Its potential for preschool assessment needs to be utilized.

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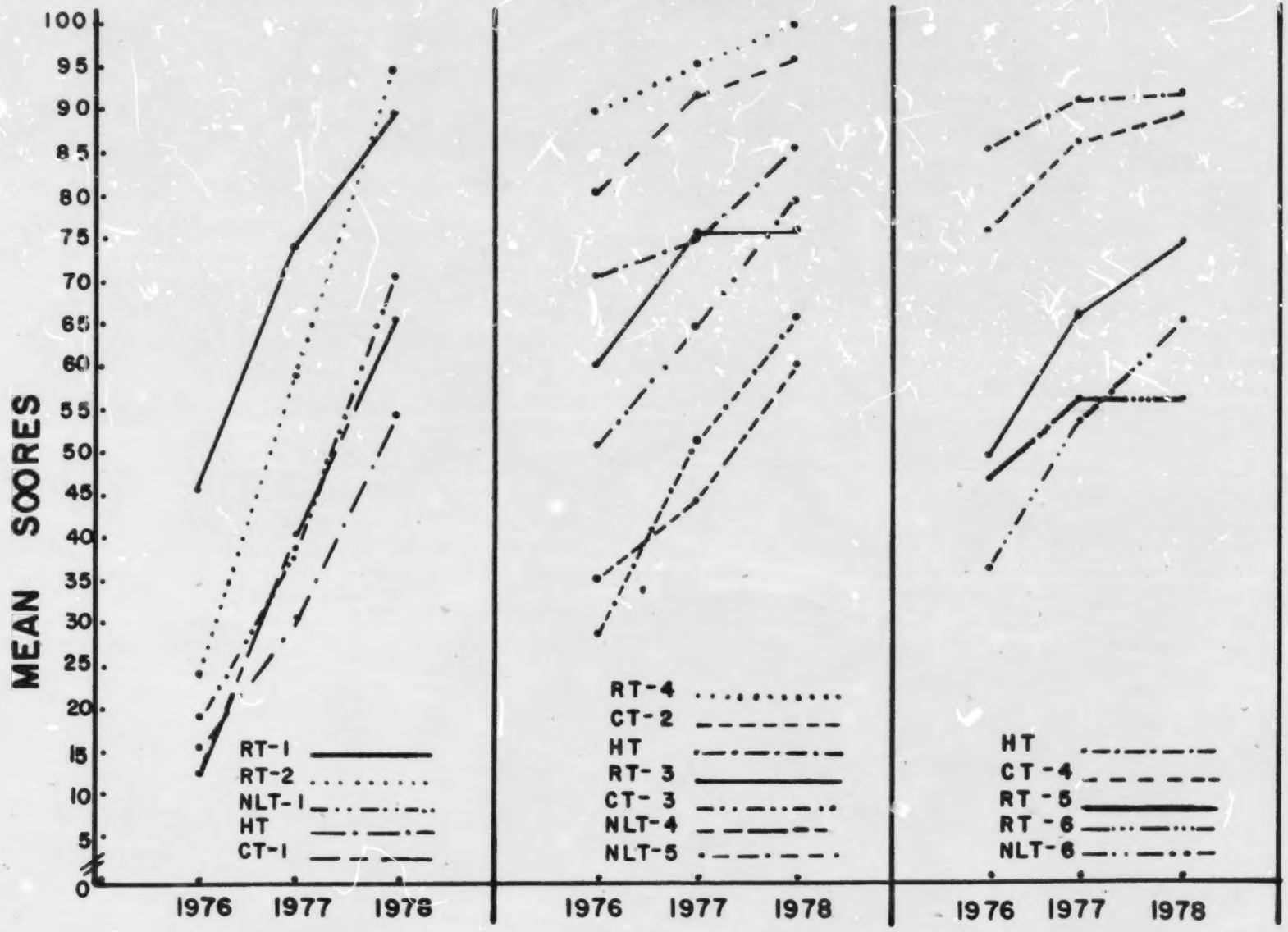
FOOTNOTES

1. This study used the same sample and the same cognitive data as utilized for the NC-124: A Life Span Analysis of Rural Children's Mental and Social Development. This is a regional project in which several mid-western states of the U.S.A. are cooperating. The participating states are: Illinois, Indiana, Iowa, Kansas, Michigan, Nebraska, Wisconsin, and Missouri. Support for the NC-124 has been provided by the Experiment Stations of their respective State Universities.
2. Dr. H. Whitt, Director Bureau of Sociological Research, University of Nebraska-Lincoln, drew the Nebraska sample in accordance with the NC-124 guidelines.
3. The NC-124 Screening Form developed at Iowa State was used. The eligibility criteria included such things as family intactness, continuous residence on a farm of ten acres or more, deriving some income from farm, having a child of appropriate age, etc.
4. The NWCAB was developed for the NC-124 under the direction of Violet Kalyan-Masih, Ph.D., University of Nebraska-Lincoln and William Marshall, Ph.D., University of Wisconsin-Madison. Information about the NWCAB Manual and Testing Kit may be obtained from W. Marshall.

FIGURE 1



3-5 YEAR OLD SUBJECTS

6-8 YEAR OLD SUBJECTS

9-11 YEAR OLD SUBJECTS

TABLE 1

The Nebraska NC-124 Sample

Year of Assessment		
1976	1977	1978
3(N=40) Group 1 ---------->	4(N=36) Group 2 ---------->	5(N=34) Group 3
	4(N=21) Group 4 ---------->	5(N=20) Group 5
		5(N=20) Group 6
6(N=41) Group 1 ---------->	7(N=38) Group 2 ---------->	8(N=37) Group 3
	7(N=21) Group 4 ---------->	8(N=19) Group 5
		8(N=20) Group 6
9(N=40) Group 1 ---------->	10(N=36) Group 2 ---------->	11(N=34) Group 3
	10(N=21) Group 4 ---------->	11(N=20) Group 5
		11(N=19) Group 6
TOTAL N=121	N=173	N=223

TABLE 2

Size, Mean Age in Months, and Sex of Each Subgroup

Age Level	1976	1977	1978
Age level 1 3-5 yr.	1) N=40 (20m, 20f) $\bar{X}$=38.2	2) N=36 (17m, 19f) $\bar{X}$=49.2	3) N=34 (16m, 18f) $\bar{X}$=60.7
		4) N=21 (9m, 12f) $\bar{X}$=49.1	5) N=20 (9m, 11f) $\bar{X}$=61.4
			6) N=20 (9m, 11f) $\bar{X}$=61.2
Age level 2 6-8 yr.	1) N=41 (23m, 18f) $\bar{X}$=74.2	2) N=38 (22m, 16f) $\bar{X}$=85.8	3) N=37 (22m, 15f) $\bar{X}$=97.8
		4) N=21 (16m, 5f) $\bar{X}$=85.3	5) N=19 (14m, 5f) $\bar{X}$=97.6
			6) N=20 (11m, 9f) $\bar{X}$=97.7
Age level 3 9-11 yr.	1) N=40 (18m, 22f) $\bar{X}$=109.6	2) N=36 (15m, 21f) $\bar{X}$=121.0	3) N=34 (14m, 20f) $\bar{X}$=133.1
		4) N=21 (7m, 14f) $\bar{X}$=121.8	5) N=20 (7m, 13f) $\bar{X}$=133.9
			6) N=19 (9m, 10f) $\bar{X}$=133.7

TABLE 3

Arrangement of Tasks According to Age Level

	RELATIONS	CLASSIFICATION	NUMBER AND LENGTH
3-5 yr. olds	1. Simple Seriation (7 trees)	1. Free Sorting and Specified Sorting	1. Cardinal Correspondence (10 trees and 10 pots)
	2. Double Seriation without Transformation (7 trees and 7 pots)		2. Length Identity
			3. Length Equivalence
6-8 yr. olds	*3. Additive Seriation (Insertion - 6 more trees)	*2. Some-All	*4. Number and Length Conflict (Houses and Streets)
	4. Double Seriation with Transformation (7 trees and 7 pots)	3. Class Inclusion	5. Cardinal and Ordinal Correspondence (10 hurdles and 11 mats)
9-11 yr. olds	*5. 16 Element Matrix (Apples)	*4. Combinatorial Reasoning	*6. Proportional Reasoning (Rabbit Hop)
	6. Verbal Seriation		

* If breaks in testing are necessary, break at these points.

TABLE 4

Means and Standard Deviations of Children of the Three Age Levels on House-Tree Task for the years 1976, 1977, and 1978.

	1976	1977	1978
Age level 1 3-5 yr.	Mean Age = 3 yrs. N = 39 $\bar{X}$ = 1.74 Group 1 →	Mean Age = 4 yrs. N = 36 $\bar{X}$ = 3.42 Group 2 → SD = 1.99	Mean Age = 5 yrs. N = 34 $\bar{X}$ = 5.91 Group 3 SD = 1.76
	SD = 1.16	N = 21 $\bar{X}$ = 4.19 Group 4 → SD = 2.02	N = 20 $\bar{X}$ = 5.80 Group 5 SD = 2.33
			N = 20 $\bar{X}$ = 6.15 Group 6 SD = 1.85
Age level 2 6-8 yr.	Mean Age = 6 yrs. N = 41 $\bar{X}$ = 7.78 Group 1 →	Mean Age = 7 yrs. N = 38 $\bar{X}$ = 8.29 Group 2 →	Mean Age = 8 yrs. N = 37 $\bar{X}$ = 9.32 Group 3
	SD = 1.28	SD = 1.25	SD = 1.36
		N = 21 $\bar{X}$ = 7.95 Group 4 → SD = 1.77	N = 19 $\bar{X}$ = 8.68 Group 5 SD = 1.20
			N = 20 $\bar{X}$ = 9.10 Group 6 SD = 1.37
Age level 3 9-11 yr.	Mean Age = 9 yrs. N = 40 $\bar{X}$ = 9.35 Group 1 →	Mean Age = 10 yrs. N = 36 $\bar{X}$ = 9.97 Group 2 →	Mean Age = 11 yrs. N = 34 $\bar{X}$ = 10.09 Group 3
	SD = 1.49	SD = 1.11	SD = 1.03
		N = 21 $\bar{X}$ = 9.38 Group 4 → SD = 1.28	N = 20 $\bar{X}$ = 9.80 Group 5 SD = 1.15
			N = 19 $\bar{X}$ = 9.68 Group 6 SD = 1.25

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